

FINAL
WORK PLAN

REMEDIAL INVESTIGATION/
FEASIBILITY STUDY

CHISMAN CREEK,
VIRGINIA

EPA WA 83.3L37.0
W63237.00

September 21, 1984

OPA COPY

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September 24, 1984

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Mr. Walt Graham
Remedial Site Project Officer
U.S. Environmental Protection Agency
Curtis Building
Sixth and Walnut
Philadelphia, Pennsylvania 19106

Dear Walt:

Subject: Work Assignment No. 83-3137.0
Chisman Creek, Virginia, Superfund
Remedial Investigation/Feasibility Study
Final Work Plan

We are pleased to submit this final work plan for the Chisman Creek, Virginia, Remedial Investigation/Feasibility Study. This plan incorporates comments received at the April 23, 1984 public meeting and your comments as a result of your review to become familiar with the project.

Please note the Final Work Plan Approval Form was previously signed. Thus, no OP Form 60 is included and no additional approval required for completion of the Chisman Creek Project.

If you have any questions or additional comments please call me at (703) 620-5200.

Sincerely,

Michael S. Thompson, P.E.
Site/Project Officer

ps

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EXECUTIVE SUMMARY

This work plan was prepared and submitted as a requirement of the REM/FIT contract for remedial planning of uncontrolled hazardous waste sites. The principal objectives of the RI/FS described in this work plan are:

- (1) to determine the nature and extent of contamination at the Chisman Creek Superfund Site, York County, Virginia;
- (2) to determine whether the contaminants pose a threat to the public or the environment;
- (3) to identify and evaluate the most cost-effective alternatives for remedial actions;
- (4) to prepare a conceptual design of the remedy selected by the U.S. EPA.

The work plan includes a detailed description of the various tasks to be performed, as well as a task-by-task breakdown of the estimated budgets and costs. The remainder of the project is presently scheduled to run about 11 months, and the total project cost is estimated to be

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INTRODUCTION

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This work plan describes the scope of activities to be performed under Work Assignment (WA) 83.3L37.0, Remedial Investigation and Feasibility Study (RI/FS) of the Chisman Creek Site in York County, Virginia. This plan incorporates requirements of the Work Assignment and the National Contingency Plan. Approximately 11 months will be required to complete the remainder of the work assignment. Estimates of costs, work hours, and a revised schedule of tasks are included in this plan.

OBJECTIVES

The objectives of the Remedial Investigation/Feasibility Study recommended for the Chisman Creek Site are to:

- o determine the extent of health and environmental problems at the site.
- o identify specific contaminants which may pose hazards to public health.
- o identify pathways of contaminant migration from the site as well as the impact of contaminants on potential receptors.

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- o describe physical features of the site that could affect migration of contaminants, methods of containment, or other methods of remedial action.
- o develop and evaluate remedial action alternatives.
- o prepare a conceptual design of the selected remedial action alternative.

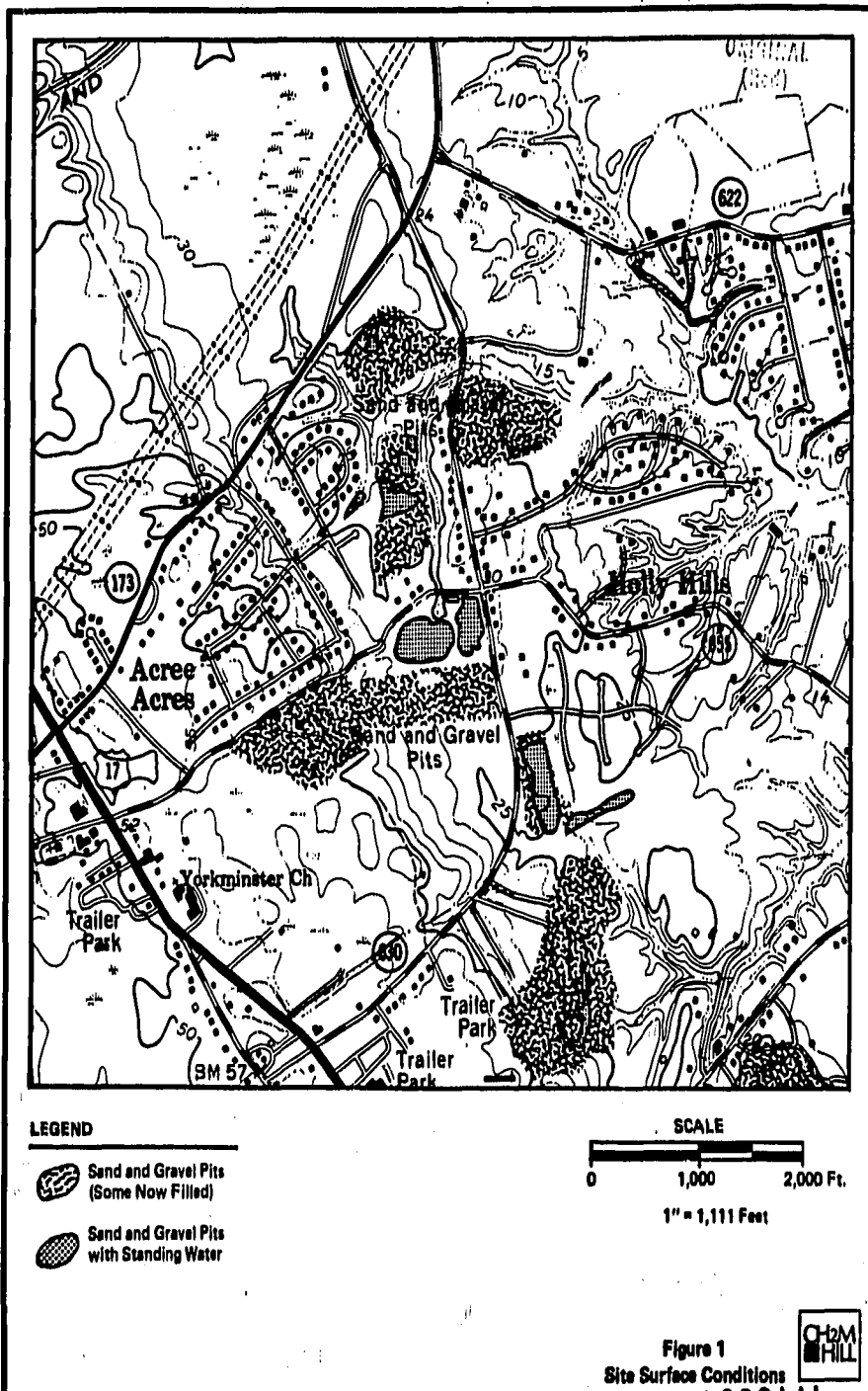
SITE BACKGROUND AND DESCRIPTION

The Chisman Creek Site is located on Wolftrap Road in York County, Virginia, near the town of Grafton and the subdivisions Acree Acres and Holly Hills (Figures 1 and 2). Flyash from a nearby power station was buried in four abandoned borrow pits between 1957 and 1975. Flyash was subsequently removed from one of the pits (Area D) and replaced with demolition waste. Approximately 1.3 million cubic yards of flyash remain in Disposal Areas A, B, and C. Flyash in parts of Area B is exposed and eroding; the other two areas are vegetated, but the nature of cover materials (if any) is not known.

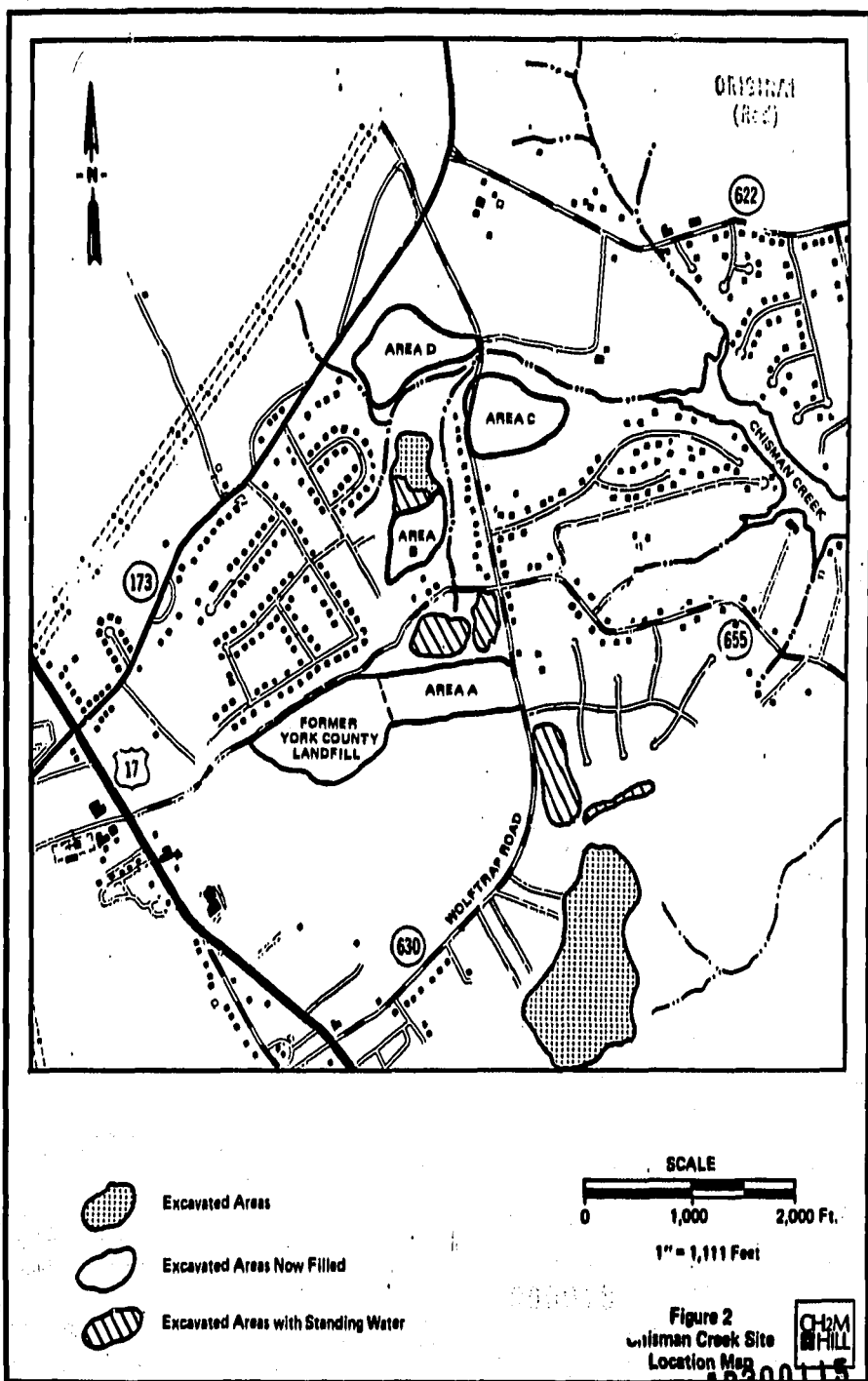
In 1980, a domestic well in the vicinity of the pits was reported to be producing discolored water. A subsequent investigation of nearby domestic wells, conducted by the Virginia State Department of Health (SDH) and State Water

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Control Board (SWCB) in 1981, revealed elevated levels of ^{ORIGINAL} _(Red) vanadium, selenium, cadmium, nickel, and arsenic in some wells. A study by the Virginia Institute of Marine Sciences (VIMS) in 1983 found that groundwater in and adjacent to the flyash at Area C was contaminated with heavy metals. Municipal water service has been extended in those areas with wells known to be contaminated. There has been no comprehensive inventory of private wells in the area, so that it is not known if other private wells remain in use or are contaminated.

The flyash pits were originally excavated in the Tabb Formation, a sandy, beach deposit of moderate to high permeability. Locally, the thickness of the Tabb Formation ranges from 20 to 30 feet below the surface; the Tabb is underlain by the Yorktown Formation. The Yorktown is a shallow marine deposit that consists of greenish-gray, shelly clay. The permeability of the Yorktown is relatively low and is thought to influence the movement of leachate from the flyash by forcing contaminants to move laterally along the Tabb-Yorktown interface.

The flyash disposal pits are located within a 100-acre area in the Chisman Creek Watershed, which discharges to the Poquoson River estuary and Chesapeake Bay. The lower reaches of Chisman Creek are tidal. Anecdotal evidence suggests that flyash from the pits has been carried into

Chisman Creek by erosion and runoff; however, the VIMS study did not find conclusive evidence of heavy metal contamination attributable to the flyash in the waters, sediments, or biota (oysters) of Chisman Creek or the Chisman/Poquoson estuary.

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Land uses in the vicinity of the pit are mixed. Primary uses are for (1) residences, including ongoing construction of subdivisions, (2) mining of sand and gravel, primarily from the Tabb Formation, and (3) disposal of demolition wastes in sand and gravel pits. In addition, an inactive municipal landfill (the York County Landfill) is situated west of Area A; the landfill is undergoing final closure.

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SCOPE OF WORK

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REMEDIAL INVESTIGATION (RI)

TASK 1--INITIAL SITE RECONNAISSANCE

An initial meeting for the Chisman Creek Work Plan was held January 5, 1984, at various locations around the site. In attendance were M. Thompson and H. Harris of CH2M HILL; E. Johnson and J. Donovan of U.S. EPA; R. Masiello, G. Suidyla, and A. Willett of the Virginia State Water Control Board (SWCB), and H. Mueller and H. Winer of the Virginia State Department of Health (SDH). Discussions at the meeting covered background information, RI project objectives, critical issues, and lines of communication and reporting. Natural and man-made features of the site and surroundings were observed and discussed, and details of previous site investigations were described by EPA and State personnel.

CH2M HILL team members also visited Dr. G. Johnson of the College of William and Mary on January 5, 1984. Dr. Johnson contributed to the VIMS study and conducts an active program of geologic investigations in the vicinity of the site. Pertinent geologic and hydrogeologic features of the site were discussed. At the recommendation of Dr. Johnson,

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CH2M HILL team members visited significant exposures of geologic materials in the vicinity of the site.

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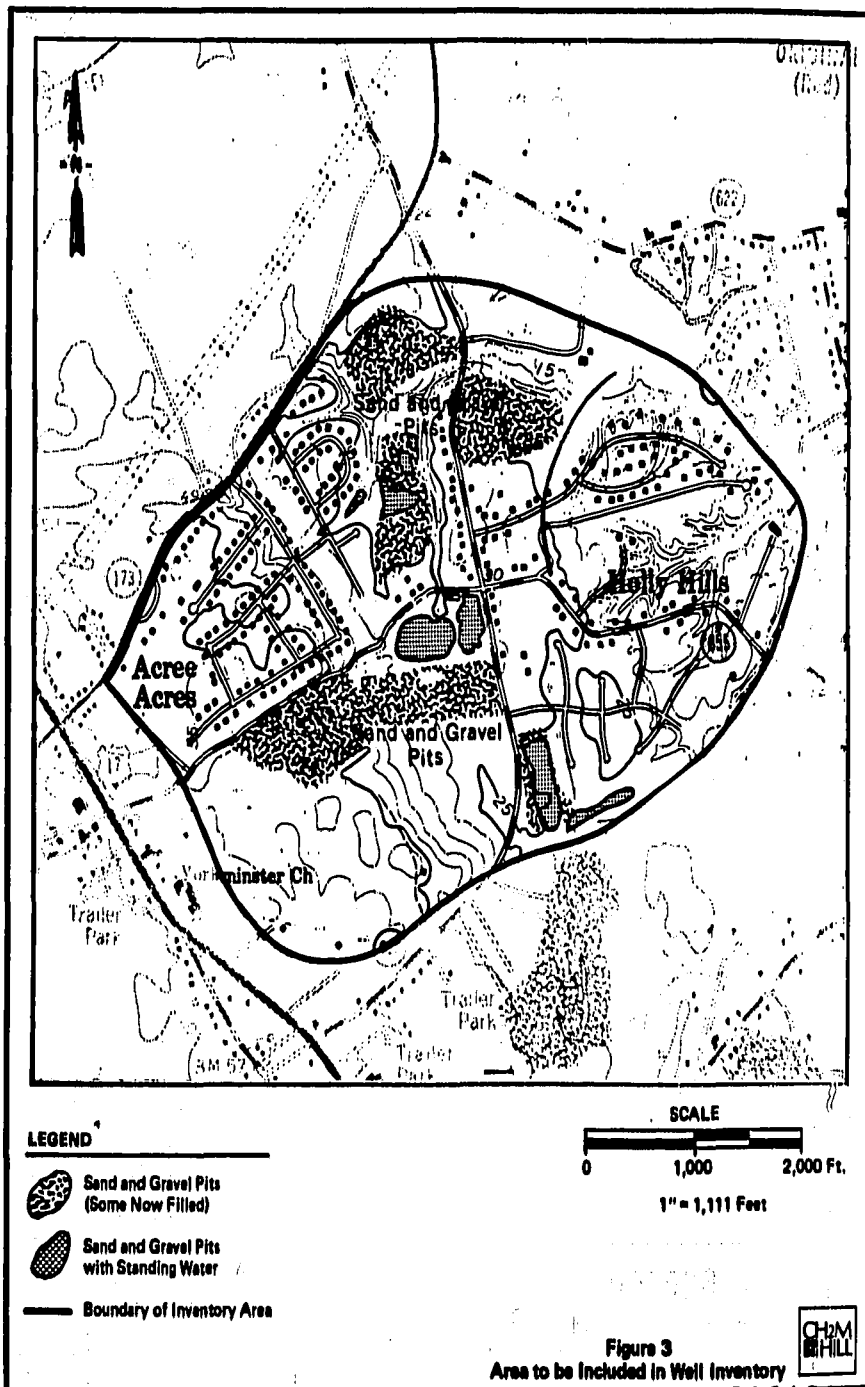
TASK 2--PREPARE WORK PLAN

Information obtained from EPA and State of Virginia files and gathered during the initial site visit was used to prepare this final work plan. This final work plan also incorporates comments from CH2M HILL, U.S. EPA, State and York County reviewers, as well as pertinent input from information/concerns received through public comment activities. Pertinent documents included (1) the National Priority List summary of actions taken at Chisman Creek; (2) results from the Hazard Ranking System assessment of the site; (3) a toxicological review of health hazards associated with metals contamination on and around the site; (4) reports of the investigations performed by VIMS and D'Appolonia; and (5) correspondence among U.S. EPA, State and County agencies, and other concerned parties.

A final draft of the work plan, incorporating comments from U.S. EPA and State reviewers, will be prepared.

TASK 3--COLLECT EXISTING DATA

The primary objective of this task will be to inventory private drinking-water wells within the bounded area shown in Figure 3. The inventory will be conducted by C.C.



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Johnson and Associates of Silver Spring, Maryland, a firm specializing in environmental investigations. Where possible, the well inventory will include the number, locations, ages and uses of wells; construction practices and materials used; and the depth range of the screened interval. Information will be collected through interviews with home owners and well drillers, and a review of any well-log data in York County or State files.

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Collection of other pertinent, existing data will continue throughout the early stages of the RI as the data become available.

TASK 4--PREPARE HEALTH AND SAFETY PLAN

Information obtained in previous tasks will be used to develop a site-specific Health and Safety Plan. The plan will indicate the type of protective gear to be worn on the site and decontamination procedures to be used upon egress from the site. An emergency response plan and onsite monitoring requirements will also be described in the plan. Modifications of the plan will be made as necessary, as additional data are gathered during field investigations. Copies of the Health and Safety Plan will be provided to U.S. EPA for review and comment.

The Chisman Creek Site encompasses three areas thought to contain toxic metals, including selenium, vanadium, cadmium,

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chromium, nickel, arsenic and copper. The level of protection required is expected to be minimal, because contaminants are apparently present in relatively low concentrations and because the waste cells are largely vegetated. Possible physical hazards should also be minimal, since the site is inactive and has no unusual features or record of previous worker injuries.

TASK 5--PREPARE QUALITY ASSURANCE PLAN

A quality assurance (QA) plan will be developed for the field investigation activities. The plan will incorporate, by reference, the appropriate portions of the general Zone II REM/FIT QA project plan. The plan will address the specific needs of the work assignment, and will incorporate any additional procedures requested by the U.S. EPA. Copies of the QA plan will be provided to the U.S. EPA for review and comment.

TASK 6--PREPARE SAMPLING PLAN

The sampling plan for the site will describe protocols for the sampling and analysis of soils, surface waters, sediments, and well waters. Preliminary descriptions of sampling locations and procedures are given in Tasks 12 through 15, below.

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The sampling plan will incorporate portions of the site-specific quality assurance plan (Task 5), appropriate EPA monographs, and CH2M HILL Standard Operating Procedures. The plan will describe sample sites, the basis for selecting the sites, the number of samples to be taken, sampling methodologies, the sampling equipment required, the types of containers to be used for collecting and shipping samples, preservation methods for the various types of samples, shipping methods, and chain-of-custody procedures. Analytical procedures will also be specified. The numbers of individuals required to complete each task and the estimated duration of each task will also be detailed.

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A draft sampling plan will be submitted to U.S. EPA and Virginia State Health Department for review and comment. After incorporation of review comments, a final sampling plan will be submitted to U.S. EPA.

TASK 7--MOBILIZATION

Mobilization comprises all preparations for the field investigation tasks, including setting up laboratory procedures, obtaining sample containers, making arrangements for the shipping of samples, and obtaining the necessary field equipment. Also included in this task are demobilization and cleanup activities.

The cost estimate for this task is based upon the assumption that "Level D" (safety boots, coveralls, safety glasses, and work gloves) protection will be sufficient for most field activities, that decontamination requirements will be minimal, and that field work will not be undertaken in the winter.

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TASK 8--PROCURE SUBCONTRACTORS

The services of subcontractors will be heavily utilized in surveying, mapping, geophysical investigations, subsurface investigations and well drilling. Other field investigations will also employ subcontractors; and the bulk of the FS will be conducted by subcontractors under CH2M HILL's supervision.

Subcontractors will be procured according to the procedures described in the Zone II Remedial Planning/Field Investigation Team Management Plan. The following steps will be followed in procuring subcontractors:

- o Selection of procurement method;
- o Prequalification of proposers/bidders;
- o Negotiating/bidding;
- o Evaluation;

o ZPMO and EPA review;

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o Subcontract award and administration.

TASK 9--COMMUNITY RELATIONS SUPPORT

The U.S. EPA will take the lead community relations role at the Chisman Creek Site. The community relations duties of the RI/FS team will thus be limited to providing advice or assistance to the U.S. EPA. Assistance may take the form of: participation in public workshops or community meetings, preparation of fact sheets or newsletters, assisting with press tours at the site, and participation in interviews. All prepared or written material will be submitted to the U.S. EPA for review prior to release.

TASK 10--PERMITS, RIGHTS OF ENTRY, OTHER AUTHORIZATIONS

Drilling permits may be required for additional monitoring wells on and near the site. The procurement of any permits will be the responsibility of the subcontractors hired to drill the wells. Rights of entry from property owners will also be required for purposes of ground surveying, geophysical investigations, installation and sampling of monitoring wells, and the sampling of domestic wells and surface waters in the area. These rights of entry will be obtained by the U.S. EPA with the assistance of CH2M HILL

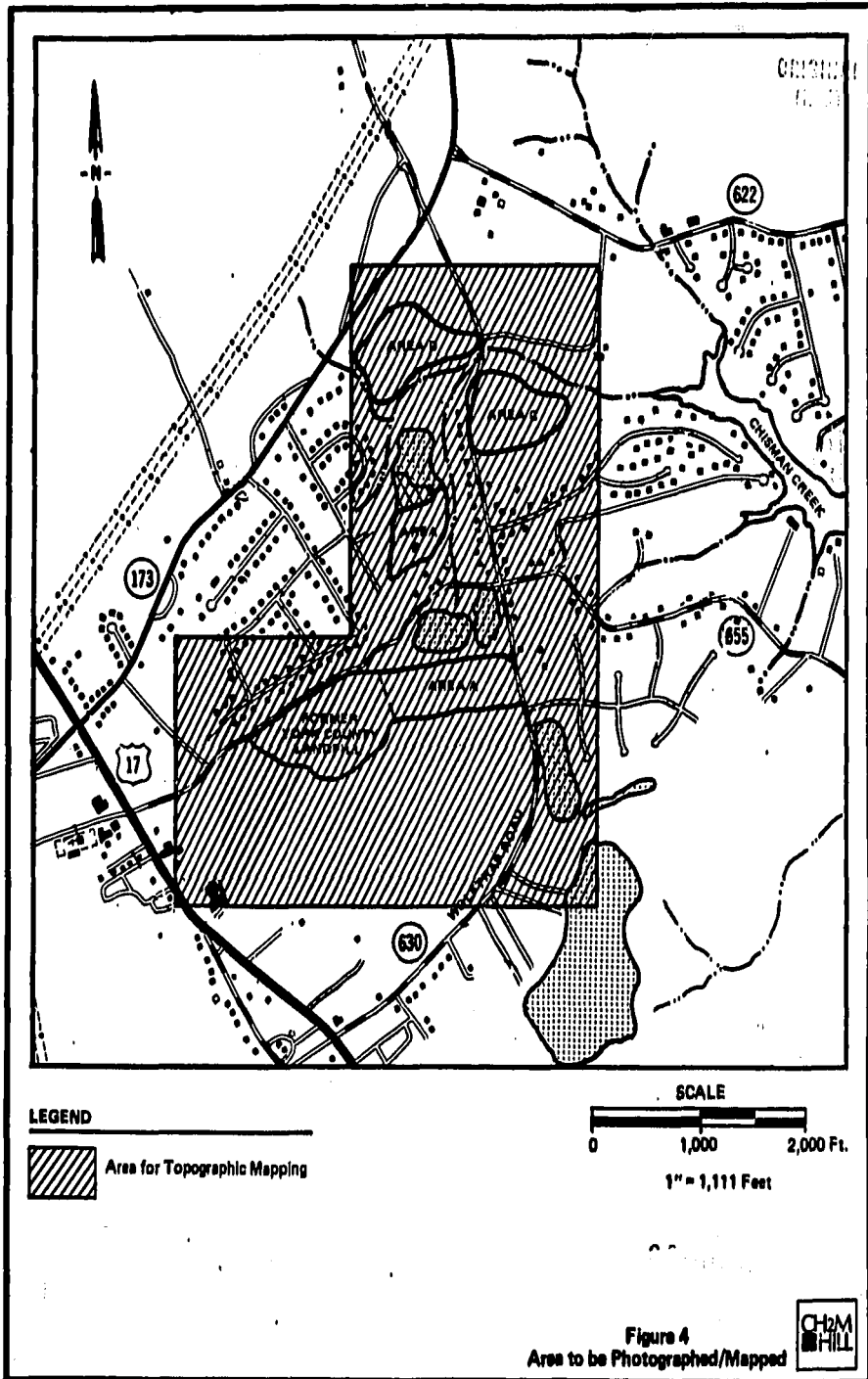
and state agencies. Such assistance may take the form of a ORIGINAL
letter addressed to property owners requesting permission to (Red)
perform the activity in question on their lands.

TASK 11--TOPOGRAPHIC MAPPING

A ground survey and aerial photography will be performed to create a topographic map showing the locations and elevations of pertinent surface features. The map will be used in subsequent Remedial Investigation activities and in developing and assessing remedial actions.

Aerial photographs will be obtained for the entire 1480-acre area shown in Figure 4. Initially, however, only a smaller (350-acre) area will be mapped. If necessary, the mapped area can be enlarged later in the project to include any part of the photographed area.

If adequate aerial photographs already exist, they will be used to prepare the topographic map. However, because there have been recent disturbances (such as construction, filling, and excavation) in the vicinity of the site, it will probably be necessary to obtain new photographs. A ground control survey will be conducted to establish horizontal and vertical reference points for any aerial photography. The horizontal control will be the basis for an



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assumed coordinate system, and the vertical control will be tied into the National Geodetic Vertical Datum.

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Maps will be prepared at a 1" = 100' scale, with 2-foot contours. These will be used to prepare a 1" = 500' scale map for use in the RI and FS reports. A technical memorandum giving the method and results of the topographic survey will also be produced.

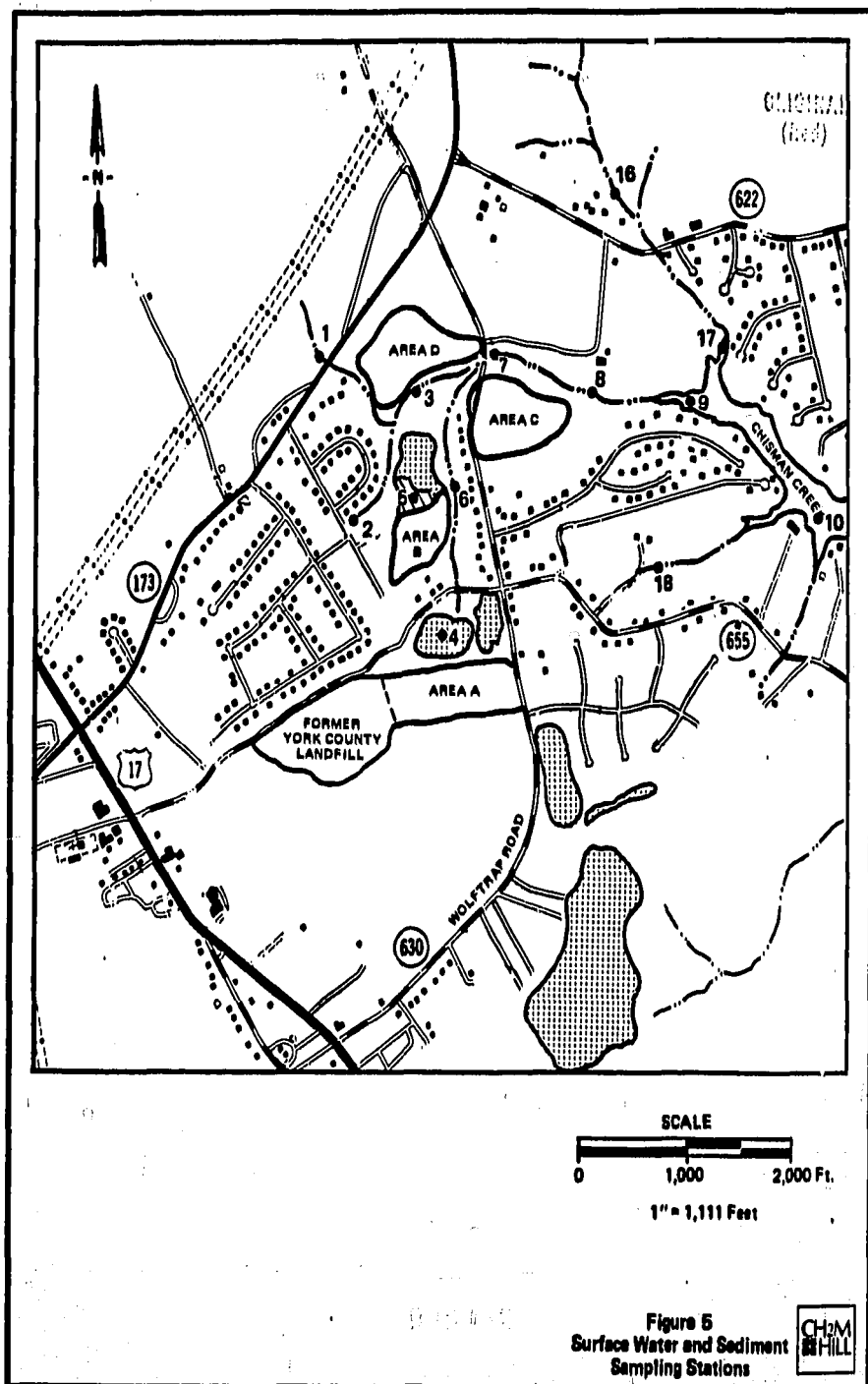
TASK 12--SURFACE WATER AND SEDIMENT SAMPLING

Surface water and sediment samples will be collected to assess the migration of hazardous substances from the site. The sampling program is intended to verify and expand on the VIMS study, which focused on Area C. The sampling plan is described here in preliminary form; details of the sampling plan will be defined during Task 6.

Surface water and sediments will be collected from eighteen stations; approximate station locations are shown on Figures 5 and 6. Station locations will be confirmed after a reconnaissance of the site.

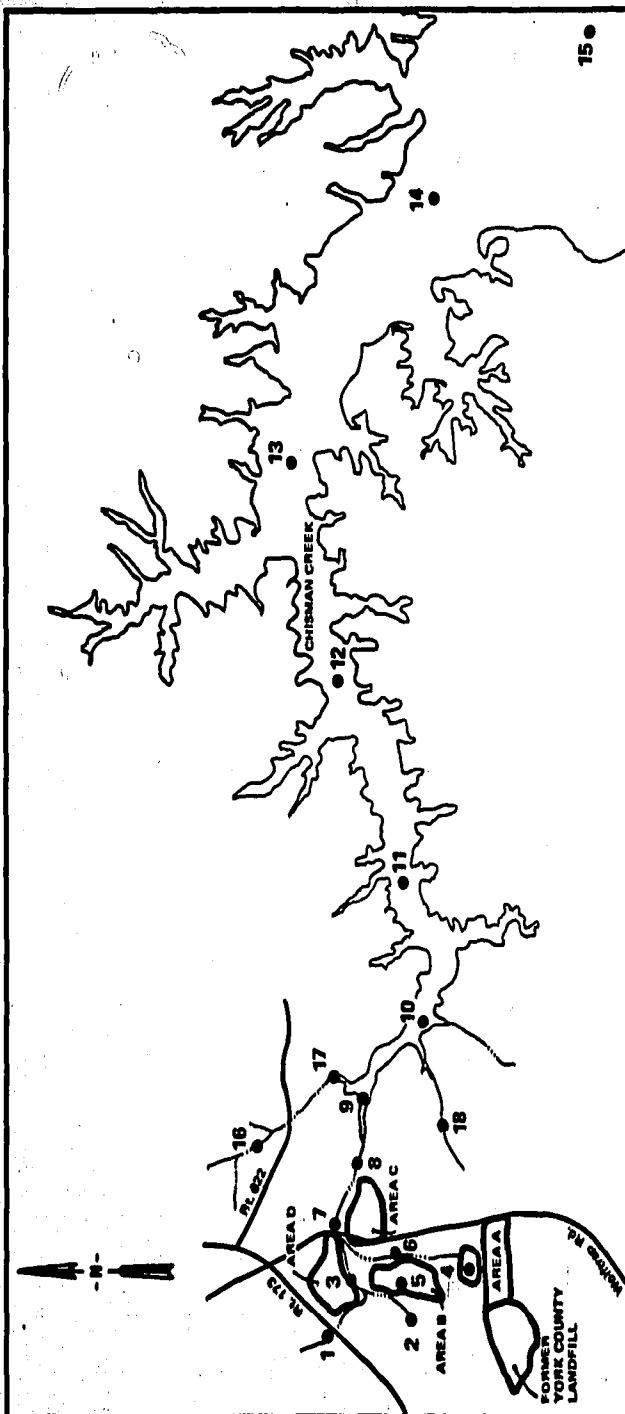
Subtask 12.1 Surface Water Sampling

Water samples will be collected twice, once immediately after a rainstorm and again during relatively dry weather,



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Figure 6
Surface Water and Sediment
Sampling Stations in
Chisman Creek and Tributaries

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to evaluate the relative contribution of contaminants from ^{ORIGINAL} groundwater and surface runoff. ^(Red) Measurements of temperature, dissolved oxygen, pH, and conductivity will be made at each station. Unfiltered samples from all stations will also be analyzed for the parameters listed in Tables 1 and 2. Additional samples from Stations 1, 6, 7, 9, and 10 will be filtered prior to preservation and analyzed for the parameters listed in Tables 1 and 2. This procedure will allow distinction of dissolved and particulate constituents. To determine whether other types of pollutants are present at the Chisman Creek Site, unfiltered samples from stations 1 and 9 will be analyzed for the parameters in Table 3, which lists all priority pollutants as well as significant non-priority pollutants.

Subtask 12.2 Sediment Sampling

Sediments will be sampled once, during dry weather conditions. Samples from Stations 1 and 9 will be analyzed for the parameters listed in Table 3. Samples from the remaining stations will be analyzed for the appropriate parameters in Tables 1 and 2.

TASK 13--GEOPHYSICAL INVESTIGATIONS

Surface geophysical methods will be used to provide additional information on flyash distribution, stratigraphic

Table 1
FIELD PARAMETERS AND MAJOR IONS

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Temperature	Calcium
pH	Magnesium
Conductivity	Potassium
Total Dissolved Solids	Sodium
	Chloride
	Sulfate
	Alkalinity

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Table 2
PRIMARY ANALYTICAL PROTOCOL

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Priority Pollutant Metals

Antimony

Arsenic

Beryllium

Cadmium

Chromium

Copper

Lead

Mercury

Nickel

Selenium

Silver

Thallium

Zinc

Other Analyses

Vanadium

Manganese

Iron

Aluminum

Molybdenum

Barium

Total Suspended Solids

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Table 3
EXTENDED ANALYTICAL PROTOCOL

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PRIORITY POLLUTANTS

Volatile Organic Compounds (31)

Acrolein	1,3-Dichloropropene
Acrylonitrile	Ethylbenzene
Benzene	Methylene chloride
Carbon tetrachloride	Methyl chloride
Chlorobenzene	Methyl bromide
1,1-Dichloroethane	Bromoform
1,2-Dichloroethane	Trichlorofluoromethane
1,1,2-Trichloroethane	Dichlorodifluoromethane
1,1,2,2-Tetrachloroethane	Chlorodibromomethane
Chloroethane	Tetrachloroethylene
2-Chloroethyl vinyl ether	Toluene
Chloroform	Trichloroethylene
1,1-Dichloroethylene	Vinyl chloride
1,2-trans-Dichloroethylene	bis (Chloromethyl) ether
1,2-Dichloropropane	

Base-Neutral Extractable Organic Compounds (46)

Acenaphthene	Nitrobenzene
Benzidine	N-Nitrosodimethylamine
1,2,4-Trichlorobenzene	N-Nitrosodiphenylamine
Hexachlorobenzene	N-Nitrosodi-n-propylamine
Hexachloroethane	Butyl benzyl phthalate
bis (2-Chloroethyl) ether	Di-n-butyl phthalate
2-Chloronaphthalene	Di-n-octyl phthalate
1,2-Dichlorobenzene	Diethyl phthalate
1,3-Dichlorobenzene	Dimethyl phthalate
1,4-Dichlorobenzene	Benzo (a) anthracene
3,3'-Dichlorobenzidine	Benzo (a) pyrene
2,4-Dinitrotoluene	Benzo (b) fluoranthene
2,6-Dinitrotoluene	Benzo (k) fluoranthene
1,2-Diphenylhydrazine	Chrysene
Fluoranthene	Acenaphthylene
4-Chlorophenyl phenyl ether	Anthracene
4-Bromophenyl phenyl ether	Benzo (g,h,i) perylene
bis (2-Chloroisopropyl) ether	Fluorene
bis (2-Chloroethoxy) methane	Phenanthrene
Hexachlorobutadiene	Dibenzo (a,h) anthracene
Hexachlorocyclopentadiene	Ideno (1,2,3-cd) pyrene
Isophorone	Pyrene
Naphthalene	
bis (2-Ethylhexyl) phthalate	

Acid Extractable Organic Compounds (11)

2,4,6-Trichlorophenol	4-Nitrophenol
d-Chloro-m-cresol	2,4-Dinitrophenol

Table 3
EXTENDED ANALYTICAL PROTOCOL
(Continued)

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2-Chlorophenol
2-Nitrophenol
Pentachlorophenol
2,4-Dimethylphenol

4,6-Dinitro-o-cresol
2,4-Dichlorophenol
Phenol

Pesticides and PCBs (26)

Aldrin
Dieldrin
Chlordane
4,4'-DDT
4,4'-DDE
4,4'-DDD
alpha-Endosulfan
beta-Endosulfan
Endosulfan sulfate
Endrin
Endrin aldehyde
Heptachlor
Heptachlor epoxide

alpha-BHC
beta-BHC
gamma-BHC
omega-BHC
PCB-1242
PCB-1254
PCB-1221
PCB-1232
PCB-1248
PCB-1260
PCB-1016
Toxaphene
2,3,7,8-Tetrachlorodibenzo
p-dioxin (TCDD)

Metals (13)

Antimony (Sb)
Arsenic (As)
Beryllium (Be)
Cadmium (Cd)
Chromium (Cr)
Copper (Cu)
Lead (Pb)

Mercury (Hg)
Nickel (Ni)
Selenium (Se)
Silver (Ag)
Thallium (Tl)
Zinc (Zn)

Miscellaneous (2)

Asbestos (fibrous)

total Cyanides

Non-Priority Pollutants

Metals

Vanadium
Iron
Molybdenum

Manganese
Aluminum
Barium

Miscellaneous

Total Suspended Solids

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relationships, and distribution of contaminants. Electrical resistivity measurements will be made using a combination of depth-sounding and lateral-profiling configurations. Detailed descriptions of the geophysical investigations will be provided during Task 6. Preliminary descriptions are given below.

Together with information obtained in Task 14, depth soundings within each disposal area may allow mapping of the base of each flyash deposit. Resistivity measurements along transects peripheral to the boundaries of the flyash deposits will also be used to create a more extensive and detailed map of the contact between the Tabb and the Yorktown Formations. Because groundwater contaminated with metals often shows elevated conductivities, these measurements may also yield information on the extent of contamination peripheral to the flyash, allowing more intelligent placement of monitoring wells. It is estimated that between 50 and 70 resistivity transects will be run at Chisman Creek.

Geophysical investigations will be performed by subcontractors under direct supervision by CH2M HILL.

TASK 14--SUBSURFACE INVESTIGATIONS

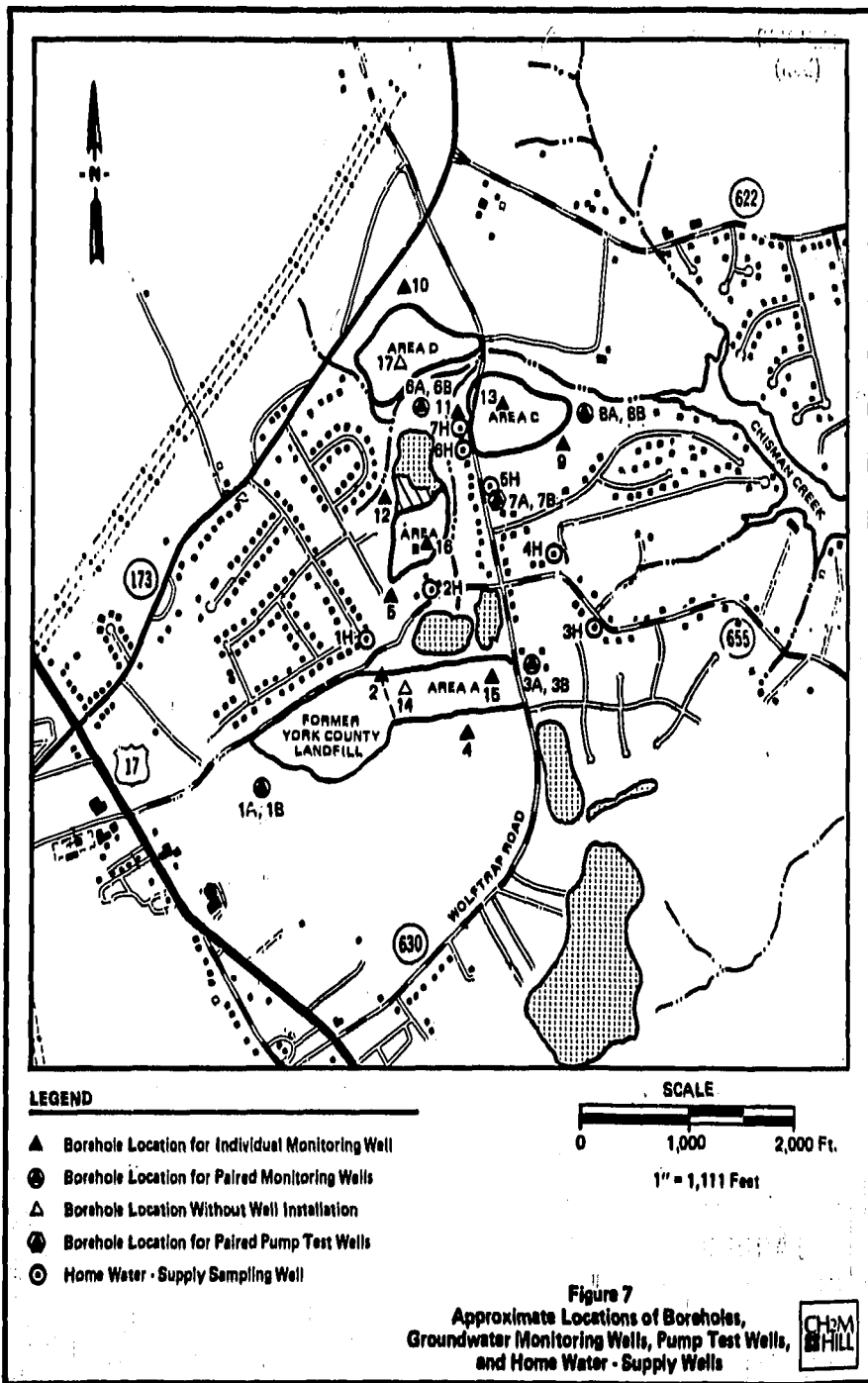
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Subsurface investigations will include borehole drilling, soil sampling, and installation of monitoring wells. Details of these subsurface investigations will be provided during Task 6. Preliminary descriptions are given below.

A total of 22 new boreholes is expected to be drilled at Chisman Creek. Monitoring wells already installed adjacent to the York County Landfill and within and adjacent to Area C will be used as piezometers only. None of these wells currently has a protective locking cap; consequently, chemical data from these wells may be of little utility in a legal proceeding. The approximate locations of all boreholes are shown in Figure 7. With the exception of Borehole 14 in Area A and Borehole 17 in Area D, all new boreholes will be used for monitoring well installation. Boreholes 14 and 17 will be backfilled with native materials after soil cores are recovered.

Drilling procedures at Chisman Creek will be designed to prevent the vertical transfer and mixing of contaminated materials in the borehole, and to minimize the possibility of cross-contamination between boreholes. Boreholes penetrating flyash deposits will be drilled to the base of the flyash using hollow stem augers, cased to prevent sloughing of flyash from the wall of the borehole, then advanced through the casing into underlying deposits. These steps, coupled with appropriate well installation

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procedures, maximize the possibility of obtaining representative groundwater samples.

Adjacent deep and shallow boreholes will be drilled at five of the drilling locations. These locations are indicated by letter subscripts in Figure 7. Locations with single boreholes, and the shallow member at paired-well locations, will be drilled to the interface of the Tabb and the Yorktown Formations. The depths of these holes are expected to range from 20 to 30 feet. Deep boreholes will be drilled into the Yorktown to depths ranging from 50 to 70 feet. Deep holes will be cased through the Tabb Formation during drilling to avoid introducing contaminated sediments or groundwater into the lower aquifer.

A geologic log will be recorded at each hole. The logs will describe the texture, strength, structure, color, mineralogy, moisture content and thickness of layers, as well as the depth to the water table. Cores will be recovered from boreholes using a standard split-spoon sampler (ASTM D1586). Boreholes through flyash deposits will be continuously cored. Eighteen-inch soil cores will be recovered at 5-foot intervals and at formation boundaries at boreholes outside of the flyash deposits. Subsamples from approximately ten of these cores will be analyzed for the appropriate priority pollutant and non-priority pollutant metals listed in Tables 1 and 2. These selected

cores will include flyash samples from the upper third and lower third of deposits in Area A and Area B, sediment cores just below the flyash deposits, and cores recovered from immediately above and below the Tabb-Yorktown Formation interface.

Monitoring wells will be installed in the boreholes as indicated on Figure 7. Wells 1A and 1B are located upgradient from the flyash disposal areas to define background water quality in the upper and lower aquifers. Four additional paired wells are located in zones of potential contamination (locations 3, 6, 7, and 8). Shallow members of these well sets will be screened above the base of the Tabb Formation. Deep wells will be screened in the Yorktown. These well sets will indicate the degree of vertical spreading of contaminants and characterize the vertical hydraulic gradient between formations.

Monitoring wells used for pump tests (see Task 15, below) will be constructed with 4-inch ID PVC well screens and standpipes. Other monitoring wells will be constructed with 2-inch ID PVC well screens and standpipes. All wells will be gravel-packed through screened intervals and sealed with bentonite. Above the bentonite seal, shallow wells will be backfilled with material removed from the hole. Deep wells will be double-cased and grouted through the upper aquifer. A vented, protective casing with a locking cap will be

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cemented below ground surface at all wells to guarantee the integrity of water samples.

Cost estimates for these activities are based on the assumption that wastes (soil and water) produced during these activities will not require special handling or disposal.

TASK 15--GROUNDWATER INVESTIGATIONS

Groundwater investigations will include piezometric measurements from the existing monitoring well network; chemical analyses of seven private water supply wells (locations shown in Figure 7); piezometric measurements at Boreholes 14 and 17; piezometric measurements and chemical analyses of samples from monitoring wells installed in the 20 additional boreholes; and pump tests at Boreholes 7A and 7B. Details of these investigations will be provided during Task 6; preliminary descriptions are given below.

Pump tests will be conducted at a constant discharge rate over 8 hours, or until a steady-state water table develops. Neighboring wells will serve as observation points during pumping and recovery. These tests will provide data for evaluating the hydraulic properties of each aquifer.

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All monitoring wells and selected private wells will be sampled and analyzed once. Samples from wells with flow rates adequate for continuous pumping will be collected after well-head measurements of Eh, pH, temperature, and conductivity stabilize. Wells without sufficient flow for continuous pumping will be bailed dry and allowed to refill prior to sample collection. Samples will be filtered in the field prior to the addition of a preservative, then packed on ice and shipped to the laboratory for analysis.

All groundwater samples will be analyzed for field parameters and major ions listed in Table 1, metals from the priority pollutant list, and any additional metals detected in previous investigations at Chisman Creek. In addition, a complete pollutant scan (Table 3) will be conducted for Well 1A (the shallow background sample) and Well 8A.

Cost estimates for these activities are based on the assumption that production water generated during sampling and pump tests will not require special handling or disposal.

TASK 16--DATA REDUCTION AND EVALUATION

Results from the preceding field investigations (Tasks 3, 11, 12, 13, 14, and 15) will be analyzed. Special emphasis will be on new discoveries and information which contradicts previously collected data.

TASK 17--ESTABLISH OBJECTIVES AND CRITERIA

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The purpose of this task is to establish remedial action objectives, and to determine the criteria on which the various remedial action alternatives will be evaluated. A meeting among personnel of the U.S. EPA, of CH2M HILL and its subcontractors, and of other interested agencies will be held to determine the objectives for the site and the evaluation criteria. Each participant will be provided with a list of potential remedial action alternatives prior to the meeting (see Task 18). After the review meeting, a technical memorandum summarizing the objectives, criteria, and evaluation process decided upon will be prepared and distributed to all participants.

TASK 18--IDENTIFY POTENTIAL REMEDIAL ALTERNATIVES

As indicated in Task 17, a preliminary list of potential remedial action alternatives will be formulated prior to the review meeting. Based upon the results of this meeting, the list of alternatives may be altered to reflect the conclusions reached during the meeting. The final list of proposed alternatives will be incorporated into the RI report and FS work plan (Task 19).

TASK 19--RI REPORT AND FS WORK PLAN

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Subtask 19.1--Remedial Investigation Report

A draft remedial investigation report will be prepared to consolidate and summarize all of the data collected during the remedial investigation. Included in this report will be a discussion of the procedures followed during the RI and the updated list of proposed remedial action alternatives. The draft will be submitted to the EPA and the Virginia State Health Department one week after the site review meeting (Task 18). Comments will be incorporated into the final report. The final report will be prepared within 10 working days after receipt of written comments on the draft report.

Subtask 19.2--Feasibility Study Work Plan

A Feasibility Study (FS) work plan will be prepared following the RI. This plan will address the scope of the feasibility study and the various tasks that must be completed during this phase of the project. Prior to the drafting of a work plan, the Site Project Manager and appropriate project staff will meet with U.S. EPA and state personnel to discuss the overall objectives and approach, areas of sensitivity, and methods for promoting cooperation among project and agency staff. A draft FS work plan will be submitted for review 15 calendar days after the meeting with the U.S. EPA. A final FS work plan incorporating

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review comments will be submitted five calendar days after receipt of the comments.

FEASIBILITY STUDY (FS)

TASK 20--TREATABILITY STUDIES

Treatability studies may be required if treatment of contaminated materials at the site is included as a remedial action alternative. Such studies may be limited to a literature review of potential treatment options or may include laboratory testing. Because the need for treatability studies at the Chisman Creek Site cannot be determined from existing information, no cost estimate is included in this work plan and no such studies are planned at this point.

TASK 21--EVALUATION OF REMEDIAL ALTERNATIVES

Alternative remedial measures will be evaluated through consideration of economic factors (e.g., capital and operating costs), environmental effects (e.g., adverse impacts of alternatives, adequacy of source control, and the degree to which the threat to the public or environment is alleviated), and engineering factors (e.g., feasibility, applicability, reliability, and estimated time from design to implementation). The evaluation consists of three steps:

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- o Develop preliminary alternatives (accomplished in Task 19)
- o Prescreen alternatives
- o Fully develop remaining alternatives

Subtask 21.1--Prescreening of Remedial Action Alternatives

The number of alternatives will be reduced to approximately three to five using the criteria listed above. The evaluations will not be rigorous in engineering detail but rather will rely heavily on engineering judgement.

Subtask 21.2--Ranking of Alternatives

The pared list of alternatives will be more fully developed. Development of the alternatives will include provision of:

- o Basic component diagrams for each alternative, including criteria, quantities of materials to be handled, efficiency of contaminant removal, and other basic information;
- o Major equipment needs and utility requirements;
- o Conceptual drawings of the site layout;

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- o Preliminary implementation schedule including procurement, construction, and operating time required to achieve objectives;
- o Estimated construction, operation and maintenance costs.

Rankings of the remedial action options will then be formulated for each of the three major assessment categories (economic, environmental, and engineering). Finally, an overall ranking will be prepared to help determine the most cost-effective alternative for the site. This ranking system will incorporate the opinions of U.S. EPA, State of Virginia, U.S. Army Corps of Engineers personnel, and public comment.

Subtask 21.3--Preparation of Feasibility Study Report

A draft report will be prepared summarizing the data developed and the procedures followed during the evaluation of remedial alternatives. Five days after the draft is submitted a meeting will be held to discuss the comments of the reviewers. After U.S. EPA and State of Virginia review of the Draft FS, a final report will be submitted. This report will be made available for public review. Final selection of a remedial measure will be made by the U.S. EPA

and State of Virginia after reviewing the feasibility study report and public comments.

TASK 22--CONCEPTUAL DESIGN

The objective of this task is to define the selected remedial action alternative(s) for the next lead agency. The task is divided into two parts: preliminary design and implementation.

Subtask 22.1--Preliminary Design

The preliminary design task consists of determining the performance expectations, preliminary layouts, preliminary design criteria and rationale, preliminary process designs, general O&M requirements, and long-term monitoring requirements of the selected remedy.

Subtask 22.2--Implementation

The implementation subtask consists of:

- o Design/implementation precautions such as permits and regulatory requirements, easements and right-of-way, health and safety requirements, community relations strategies, and special technical problems;

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- o An order-of-magnitude (+50 percent to -30 percent) implementation cost estimate, a preliminary estimate of the annual O&M costs, and a project schedule.

All plans and products developed during the conceptual design work will be given to the COE (or any other agencies responsible for implementing the remedial action measure) for review.

TASK 23--FINAL REPORT

A draft summarizing the remedial investigation, the selected remedial action, and the conceptual design effort will be prepared and submitted to the RSPO. A review meeting will be scheduled within five days of submittal of this draft. One week after receipt of written comments on the draft, a final report will be given to the RSPO.

TASK 24--PROJECT MANAGEMENT

This task incorporates all activities necessary to manage the 23 other tasks of the RI/FS.

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SCHEDULE AND BUDGET

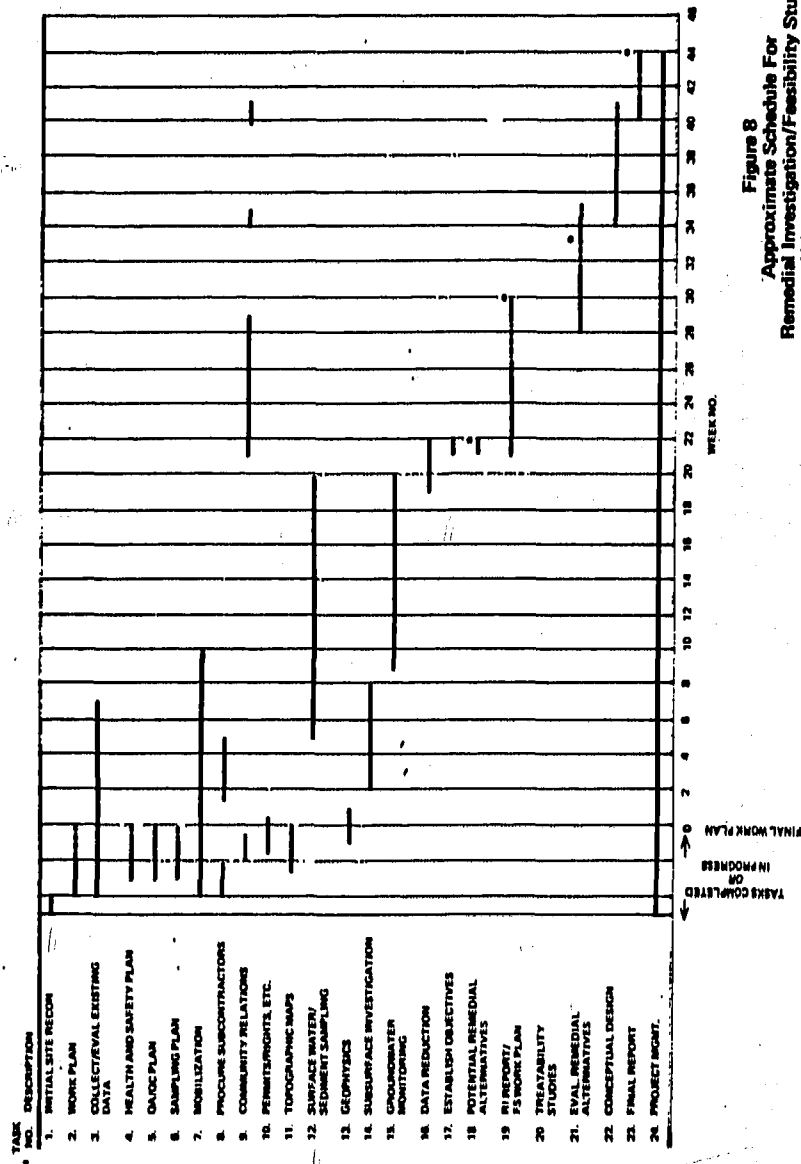
Included in this section are the revised project schedule (Figure 8), the list of project deliverables (Table 4), the anticipated meeting schedule (Table 5), and an overall project budget for the 24 tasks (Table 6). The total cost of the project is estimated to be and is expected to take about 11 months to complete.

The following assumptions have been made during the formulation of the proposed project schedule and budget:

- o U.S. EPA and State of Virginia personnel will be given approximately 2 weeks to review the draft work plan. Two weeks are scheduled for review of other drafts.
- o Preparation of the Health and Safety Plan (Task 4), the Quality Assurance Plan (Task 5), and the Sampling Plan (Task 6) can begin during EPA review of the draft work plan.
- o Tasks 8 (Procure Subcontractors), 10 (Obtain Permits, Rights of Entry, Other Authorizations), and 11 (Topographic Mapping) can begin during EPA review of the draft work plan.



Figure 8
Approximate Schedule For
Remedial Investigation/Feasibility Study
Chisman Creek, Virginia



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- o The project schedule is developed using a 45-day turn-around time on samples submitted to the EPA Contract Laboratory Program for analysis.
- o All health and safety items and field sampling equipment used during the project will be supplied by CH2M HILL or its subcontractors.
- o Bottles and preservatives for samples will be provided by CH2M HILL. Forms and tags for management and chain-of-custody of project samples will be provided by EPA.
- o The location of project meetings (except for public meetings) is assumed to be at CH2M HILL's Reston office.
- o The Corps of Engineers (COE) or the State of Virginia will have lead responsibility for the design and construction of the selected remedial action measure(s).

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Table 4
PROJECT DELIVERABLES^a
CHISMAN CREEK, VA, RI/FS
W63237.00/EPA 83.3L37.0

Deliverables	Task	Anticipated Issue Date
Draft Work Plan	1	April 30, 1984
Health and Safety Plan	4	April 30, 1984
Quality Assurance Plan	5	August 30, 1984
Draft Sampling Plan	6	April 2, 1984
Final Sampling Plan	6	August 24, 1984
Topographic Map	11	April 30, 1984
Subsurface and Geophysical Investigations Technical Memorandum	14	October 25, 1984
Summary Memorandum of Existing Data	3	November 7, 1984
Surface Water/Sediment/Ground- water Sampling Results	12, 15	January 17, 1985
Establish Objectives/Potential Remedial Alternatives Technical Memorandum	17, 18	February 7, 1985
Summary of Review Meeting (From above submittal)	17, 18	February 15, 1985
Remedial Investigation Report	19	March 14, 1985
Final Feasibility Study Work Plan	19	May 1, 1985
Feasibility Study Report	21	June 4, 1985
Final Report	22, 23	August 5, 1985

^aNot including monthly reports or daily or oral field reports.

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Table 5
 ANTICIPATED MEETING SCHEDULE
 CHISMAN CREEK RI/FS
 W63237.0/EPA 83.3L37.0

<u>Meeting</u>	<u>Task</u>	<u>Date</u>
Initial Site Visit	1	January 5, 1984
Kickoff Meeting	1	January 5, 1984
Public Meetings	-	Not Scheduled
Review Meeting	18	February 7, 1985
Review Meeting	19	March 14, 1985
Review Meeting	21	June 4, 1985
Review Meeting	23	July 30, 1985

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